# XtraDrive SERIES
# AC SERVO DRIVER

# XtraDrive-DP
## Embedded PROFIBUS

# User Manual

YASKAWA ESHED TECHNOLOGY LTD.

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Catalog No. 8U0112 June 2003

# About This Manual

This manual is intended for users who want to easily integrate the XtraDrive-DP system into a PROFIBUS network. It explains how to connect XtraDrive-DP to a PROFIBUS network and how to use standard tools to set up the behavior and functionality of the XtraDrive-DP on the PROFIBUS network.

This manual contains the following chapters:

- **Chapter 1**, **Introducing XtraDrive-DP**, describes the XtraDrive-DP servo driver and provides an introduction to PROFIBUS networking.
- **Chapter 2**, **Installing XtraDrive-DP**, describes how to connect XtraDrive-DP to PROFIBUS.
- **Chapter 3**, **Working with XtraDrive-DP**, describes the process of setting up and configuring XtraDrive-DP to work on a PROFIBUS network.
- **Appendix A, XtraDrive-DP GSD File**, provides a link to the most updated GSD file.
- **Appendix B, XtraDrive-DP Parameters List**, provides a list of configurable XtraDrive-DP parameters.
- **Appendix C, XtraDrive-DP Alarms, Warnings and Faults**, provides a list of system errors.
- **Appendix D, Working with XtraWare**, provides an overview of the PC-based XtraWare software.
- **Appendix E, Example of Using XtraDrive-DP**, describes how to set up and control an XtraDrive-DP slave. The DP configuration tool used in this example is the S7 SIMATEC Manager.

# Related Documents

The following books provide additional information:

- *XtraDrive User Manual*, Catalog No. 8U0108
- *XtraWare User's Manual*, Catalog No. 8U0109
- *XtraDrive Short Form Installation Guide*, Catalog No. 8U0107

# Table of Contents

## Chapter 1: Introducing XtraDrive-DP ..... 1

**What is XtraDrive? ..... 2**

XtraDrive with Embedded PROFIBUS (XtraDrive-DP) ..... 3

**Product Overview ..... 4**

XtraDrive-DP Specifications ..... 4

PROFIBUS Interface Specifications ..... 6

Nameplate ..... 7

Type Description ..... 8

**Introduction to PROFIBUS ..... 9**

PROFIBUS-DP ..... 9

Parameterization ..... 11

Configuration ..... 12

Data Exchange ..... 12

GSD File ..... 13

## Chapter 2: Installing XtraDrive-DP ..... 15

**Connecting an XtraDrive-DP ..... 15**

The PROFIBUS Network ..... 16

Connecting XtraDrive-DP to a PROFIBUS Network ..... 18

Setting the Node Address ..... 20

LED Indicators ..... 21

## Chapter 3: Working with XtraDrive-DP ..... 23

**Overview ..... 24**

**Setting Up XtraDrive-DP ..... 25**

Installing GSD Files ..... 25

Using Modules to Set Up XtraDrive-DP ..... 25

**Sending Commands** ..... **33**

**Setting XtraDrive-DP Parameters** ..... **37**

Setting Parameters at Parameterization ..... 37

Setting Parameters During Data Exchange ..... 38

Setting Parameters with XtraWare ..... 38

**Reading Variables** ..... **39**

**Downloading XtraDrive-DP Programs** ..... **40**

**Starting Program Synchronization** ..... **41**

**Diagnostics** ..... **42**

**XtraDrive-DP's Response to Clear Data Control Command** ..... **44**

**Appendix A: XtraDrive-DP GSD File** ..... **45**

**Appendix B: XtraDrive-DP Parameters List** ..... **47**

**Appendix C: XtraDrive-DP Alarms, Warnings and Faults** ..... **67**

**Alarm Messages** ..... **67**

**Warning Messages** ..... **69**

**Fault Messages** ..... **69**

**Appendix D: Working with XtraWare** ..... **73**

**Appendix E: Example of Using XtraDrive-DP** ..... **75**

**Specifications** ..... **75**

**Workflow** ..... **76**

System Setup ..... 76

Application Setup ..... 78

Application Execution During Data Exchange ..... 81

**Index** ..... **83**

# Safety Precautions

In this manual, safety precautions are classified as WARNING or CAUTION. It is extremely important that you pay close attention to these precautions.

The following symbols are used:

## WARNING

Indicates a potentially hazardous situation, which, if not avoided, could result in death or serious personal injury.

## CAUTION

Indicates a potentially hazardous situation, which, if not avoided, could result in minor or moderate personal injury and/or damage to the equipment. In some instances, items described in a CAUTION could also result in a serious accident.

Read the following safety precautions thoroughly before installation, operation, maintenance or inspection of the XtraDrive-DP.

# Installation

## WARNING

After voltage resistance testing, wait at least five minutes before servicing the product.

*Failure to observe this warning could result in electric shock.*

## CAUTION

Never use the equipment near flammable materials, or where it may be exposed to splashes of water or corrosive or flammable gases.

*Failure to observe this caution could result in electric shock or fire.*

# Wiring

## WARNING

XtraDrive grounding must be in accordance with the national code and consistent with sound local practices.

*Failure to observe this warning could result in electric shock or fire.*

## CAUTION

Do not connect three-phase power supply to XtraDrive output terminals U, V, and W.

*Failure to observe this caution could result in personal injury or fire.*

Securely tighten screws on the terminal block and ground terminals of power input and motor connections.

When using a 400V XtraDrive, the amount of current leaking from the power line increases. Therefore, use cables and isolation materials rated for 400V, and keep the wires as short as possible.

# Inspection and Maintenance

## WARNING

Be sure to turn power OFF before inspection or maintenance.

*Failure to observe this warning could result in electric shock.*

Never open the terminal cover while power is ON, and never turn power ON when the terminal cover is open.

*Failure to observe this warning could result in electric shock.*

After turning power OFF, wait at least five minutes before servicing the product.

*Failure to observe this warning could result in residual electric charges causing electric shock.*

## CAUTION

Never change wiring while power is ON.

*Failure to observe this warning could result in electric shock or personal injury.*

# Receiving

## CAUTION

Use the specified combination of servomotor and XtraDrive.

*Failure to observe this caution could result in fire or equipment failure.*

# Operation

## CAUTION

To avoid accidents, perform a test run of the servomotor with no load.

*Failure to observe this caution could result in personal injury.*

Before starting operation with a load connected, set up user constants suitable for the machine.

*Failure to do so could result in overrun failure. When the load moves vertically, incorrect setting of the user constants may cause the load to fall.*

Before starting operation with a load connected, make sure emergency-stop procedures are in place.

*Failure to observe this caution could result in personal injury.*

During operation, do not touch the XtraDrive's heat sink.

*Failure to observe this caution could result in burns.*

Motor overload protection is internally provided. For further information, refer to the *XtraDrive User Manual*, Catalog No. 8U0108.

# General Precautions

To ensure safe application, the following must be noted:

- The drawings presented in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- This manual is subject to change due to product improvement, specification modification, and manual improvement. When this manual is revised, the manual code is updated, and the new manual is published as a next edition. The edition number appears on the front and back covers.
- If the manual must be ordered due to loss or damage, inform your nearest YET representative or one of the offices listed on the back of this manual.
- YET will not take responsibility for the results of unauthorized modifications of this product. YET shall not be liable for any damages or problems resulting from unauthorized modification.

# Chapter 1

# Introducing XtraDrive-DP

## About This Chapter

This chapter provides a brief overview of XtraDrive-DP and its use on a PROFIBUS network.

- **What is XtraDrive?**, page 2, provides a brief introduction to XtraDrive-DP.
- **Product Overview**, page 4, provides a list of XtraDrive-DP and PROFIBUS specifications.
- **Introduction to PROFIBUS**, page 9, provides an introduction to PROFIBUS.
- **Parameterization**, page 11, provides an overview of the Parameterization stage.
- **Configuration**, page 12, provides an overview of the Configuration stage.
- **Data Exchange**, page 12, provides an overview of the data exchange stage.
- **GSD File**, page 13, provides a brief description of the GSD files.

# What is XtraDrive?

XtraDrive is a family of state-of-art, high-precision AC servo drivers. XtraDrive is based on a unique proprietary control technology, offering solutions for the most demanding applications.

XtraDrive characteristics include:

- Advanced servo control
  - High-precision During Movement (NCT Algorithm)
  - Oscillation Canceling Algorithm (OCA)
- Automatic tuning of servo parameters for optimal setting time
- Integrated positioner by various programmable motion profile modes
- 1.5 Axis (Master-Slave with automatic offset correction)
- Two analog inputs for general purpose usage
- Network connectivity

# XtraDrive with Embedded PROFIBUS (XtraDrive-DP)

XtraDrive-DP provides all the benefits of working with the XtraDrive family of products, while running on PROFIBUS network.

XtraDrive-DP uses PROFIBUS' standard diagnostic features to provide continuous diagnostics, as well as driver status and information about runtime error in motion commands.

XtraDrive-DP has PROFIBUS product certification according to EN 50170 and IEC 61158.

As XtraDrive-DP has the same parameter set, system variables, motion commands and programming functions as the rest of the XtraDrive family, it functions in a familiar and easy to-use manner. Refer to the XtraDrive and XtraWare User Manuals for detailed information about using XtraDrive.

Even when XtraDrive is connected to a network, you can use XtraWare for tuning, oscilloscope functions, program editing and program download. Refer to the *XtraWare User's Manual* for detailed information about the XtraWare software.

# Product Overview

Below are the specifications for the XtraDrive-DP and the PROFIBUS interface.

## XtraDrive-DP Specifications

| | |
|---|---|
| Servo motor capacity (kW) | 0.5 1.0 1.5 2.0 3.0 |
| Voltage | 3-Phase 400 VAC |
| Command input | PROFIBUS, Analog, pulse train |
| Integrated positioner | Various programmable motion profile modes |
| Encoder I/F | A/B (Z) encoder, serial encoder: 13, 16 or 17 -bit (incremental/absolute value) |
| Protection functions | Overcurrent, overvoltage, undervoltage, overload, regeneration error, main circuit voltage error, heat sink overheat, overspeed, encoder error overrun, parameter error |
| Digital inputs | 7 |
| Digital outputs | 7 |
| Analog input | 2 at +/- 10 VDC at rated torque |
| Analog output | 2 at +/- 10 VDC at rated torque |
| Speed control range | 1 to 6500 rpm |
| Speed-voltage regulation | Rated voltage +/- 10%: 0% (at rated speed) |
| Speed-load regulation | 0-100% load: 0.01% max. (at rated speed) |

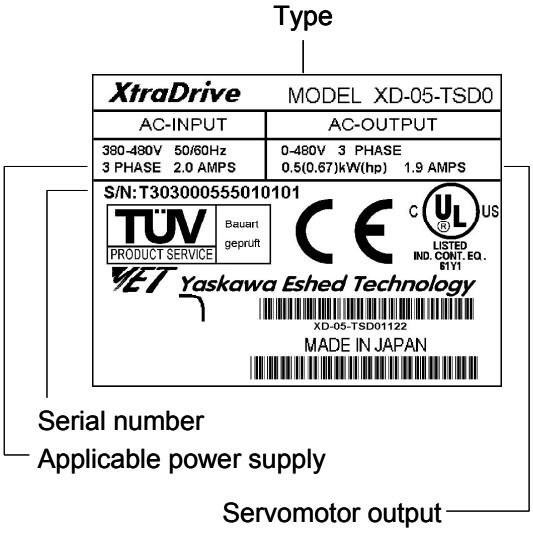
| | |
|---|---|
| External torque limitation | Input voltage +/- 12 V max. |
| Ambient/storage temperature | 0-55° C/ -20 to -85° C |
| Ambient/storage humidity | 90% or less (with no condensation) |
| Dimensions for 400W model 0.5, 1.0, 1.5 kW | LxWxH 180x110x160 |
| Dimensions for 400W model 2, 3 kW | LxWxH 180x110x250 |

# PROFIBUS Interface Specifications

| | | | |
|---|---|---|---|
| Maximum Expansion | 126 stations max. | | |
| Communication | RS-485 | | |
| Auto-configuring | GSD file | | |
| PROFIBUS Profile | DP | | |
| PROFIBUS Port | 9-pin D-shell | | |
| Node Address | 0-125 decimal<br>Set by rotary switches (2 digit hex number) | | |
| Segment distance | 100 meters (327 feet) to<br>1200 meters (3270 feet) | | |
| Baud Rate | Selectable from 9.6 kbps to<br>12 Mbps | | |
| LED Indicators:<br>BF - Bus failure<br>SF - System failure | BF | Green | Data exchange |
| | | Red | No communication |
| | | Blinking Red | Communication but not in data exchange |
| | SF | Off | Everything OK |
| | | Red | System failure |
| | | Blinking Red | Warning or alarm |

# Nameplate

A nameplate is attached to each XtraDrive-DP, providing the drive's model number and other product information. The information from this nameplate is used, for example, when placing orders for XtraDrive-DPs.

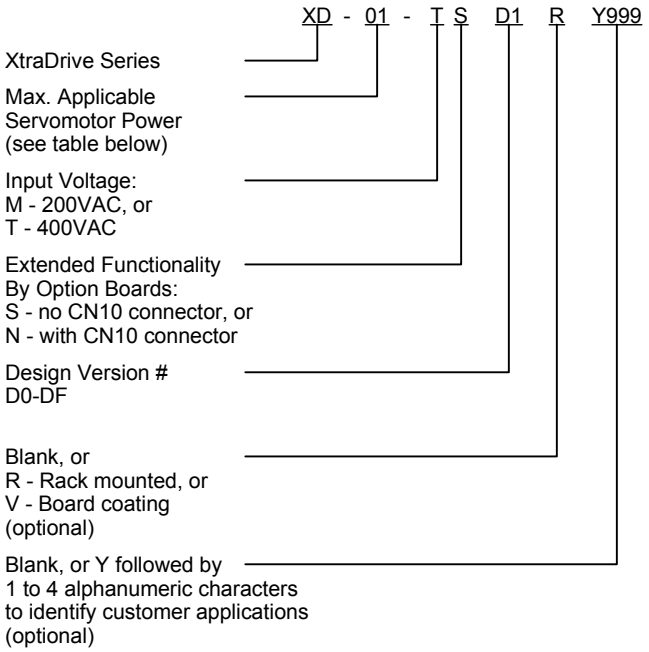



The following information is included on the nameplate:

- ✦ Serial number
- ✦ Applicable power supply
- ✦ Servomotor output

# Type Description

This section specifies the model type information for each XtraDrive-DP.




| Output Capacity Code | Max. Applicable Servomotor Power (kW) |
|---|---|
| 05 | 0.50 |
| 10 | 1.0 |
| 15 | 1.5 |
| 20 | 2.0 |
| 30 | 3.0 |

# Introduction to PROFIBUS

PROFIBUS (Process Field Bus) is a vendor-independent, open-field bus standard used in a wide variety of industries, including manufacturing, process and building automation. Many certified PROFIBUS products are available, including sensors, motor drives and starters, PLCs, remote I/O systems, and so on.

There are three types of PROFIBUS products:

- **Fieldbus Message Specification (FMS)**

  This version is designed as a general-purpose solution for communication tasks at the cell level, and can also be used for extensive and complex communication tasks.

- **Process Automation (PA)**

  This version is designed for process automation. It permits sensors and actuators to be connected on one common bus line. This version can be used for data communication and power over the bus using 2-wire technology according to IEC 1158-2.

- **Decentralized Periphery (DP)**

  This version is designed for communication between automation control systems and distributed I/O at the device level. This version can be used in place parallel signal transmission with 24V or 0 to 20 mA.

## PROFIBUS-DP

PROFIBUS-DP is a master/slave communication profile, which allows up to 126 stations on each bus. These stations perform connection-oriented communication and have a transmission rate of up to 12 Mbps. The length of the messages between the master and slave is up to 256 bytes. Information transferred from the master to the slave is called *Output*, and information transferred from the slave to the master is called *Input*.

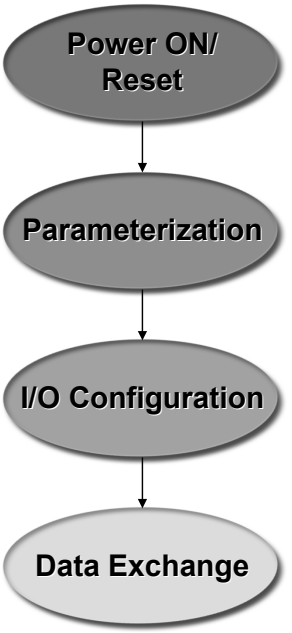
PROFIBUS allows:

- Peer-to-peer (user data communication) or multicast (control commands)
- Cyclic master/slave user data communication
- Control commands which allow synchronization of I/O

During integration of the XtraDrive-DP to the PROFIBUS network, you set up the data types and parameter values that will be transferred over the network, and then transfer this information to the master. The master then uses this information to control the XtraDrive-DP during data exchange.

This process is composed of four steps:

- **Power ON/Reset** - In this step communications are initialized between the XtraDrive-DP and the PROFIBUS network.
- **Parameterization** - In this step the parameters that you have chosen to determine XtraDrive-DP's behavior and operation are downloaded to the XtraDrive-DP slave. More detail is provided on page 11.
- **I/O Configuration** - In this step the structure of the input and output data that will be transferred between the master and the XtraDrive-DP during data exchange is downloaded to the XtraDrive-DP slave. More detail is provided on page 12.




- **Data Exchange** - In this step cyclic exchange of data and slave diagnostics is performed.

# Parameterization

During the Parameterization stage, the master downloads PROFIBUS bus parameters and XtraDrive parameters to the XtraDrive-DP. Parameterization needs to be performed only once, when the XtraDrive-DP is powered on, or after a power failure or other system restart.

The first seven bytes of a parameterization message are standard for all PROFIBUS slaves. Among other information, these first seven bytes include:

- Response monitoring time - control time for bus activity to the slave
- TSDR - minimum slave response time
- Freeze/Sync mode
- Lock or unlock slave for this master
- Master address
- Ident number - identification number for verification

Bytes 8-244 can contain additional user-defined parameters specifically for the XtraDrive-DP. Refer to *XtraDrive-DP Parameters* in *Chapter 3, Working with XtraDrive-DP* for further details.

Using a PROFIBUS DP configuration tool, you select the desired module's parameters and values. (Refer to *Appendix* B*, XtraDrive-DP Parameters List*, for a list of all available XtraDrive-DP parameters. Refer to *Appendix E, Example of Using XtraDrive-DP* for an example of how to use the S7 SIMATIC Manager to set up, parameterize and configure an XtraDrive-DP to work on a PROFIBUS network.)

**NOTE:**

After the parameterization stage, the XtraDrive-DP resets its servo circuit.

# Configuration

In the Configuration stage, you define the structure of the input and output messages that will be transmitted between the master and XtraDrive-DP during data exchange. Inputs and outputs include XtraDrive-DP system variables, physical I/O state, flags and motion commands. This stage is performed using a PROFIBUS DP configuration tool.

This information will later be downloaded to the XtraDrive-DP slave during the Configuration stage. Configuration is also performed only once, after Parameterization, when the XtraDrive-DP is powered on, or after a power failure or other system restart.

XtraDrive-DP's I/O configuration modules are all contained in the GSD file that you loaded into the PROFIBUS DP configuration tool.

# Data Exchange

During the data exchange stage the master reads inputs from the XtraDrive-DP and writes outputs to the XtraDrive-DP. These inputs and outputs are determined according to what you have defined during the Configuration stage.

# GSD File

Every product that runs on a PROFIBUS network has a GSD file (device data file) associated with it. The GSD file contains a superset of all the parameters available for a particular product. It also describes the data that can be transmitted between the master and slave during data exchange.

The information provided in a GSD file has a precisely defined format, which enables the PROFIBUS DP configuration tool to automatically use this information when configuring the bus system.

The GSD file is loaded only once, at the beginning of the setup process. Refer to *Appendix E, Example of Using XtraDrive-DP* for a complete example of how to use a PROFIBUS DP configuration tool. Information can also be downloaded from PROFIBUS' website: www.profibus.com. A copy of the most updated GSD file (YETM07AA.GSD) for the XtraDrive-DP can be downloaded from YET's website: www.yetmotion.com or from www.profibus.com.

# Chapter 2

# Installing XtraDrive-DP



## About This Chapter

This chapter describes how to connect an XtraDrive-DP to a PROFIBUS network. It provides a brief description of PROFIBUS network architecture, and gives instructions for setting the node address of each XtraDrive-DP.

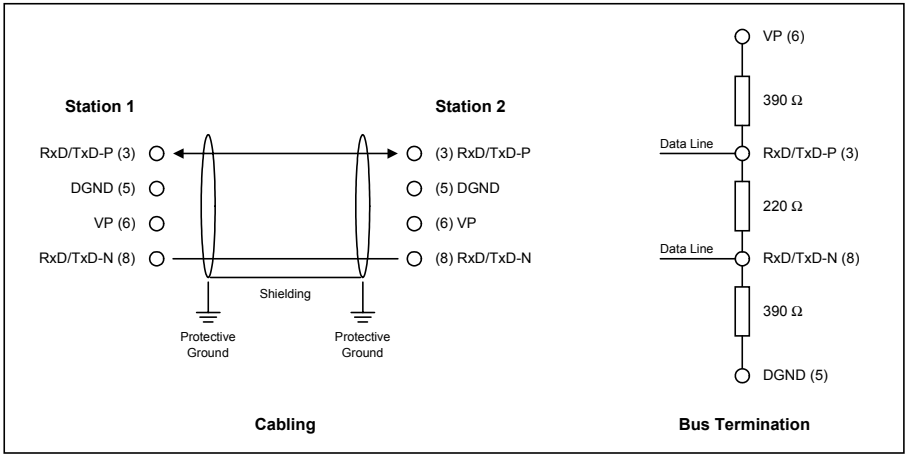
# Connecting an XtraDrive-DP

XtraDrive-DP servo drives are connected to a PROFIBUS network via a standard RS-485 communication cable.

For information on how to connect other XtraDrive series products to peripheral devices, as well as for examples of main circuit wiring and I/O signal connections, refer to *Chapter 3, Wiring* in the *XtraDrive User Manual*.

# The PROFIBUS Network

PROFIBUS devices are connected in a bus structure. Up to 32 stations (master or slaves) can be connected in one segment, and multiple buses may be connected if line amplifiers are used. The bus has an active bus terminator at the beginning and end of each segment. To ensure error-free operation, both bus terminations must always be powered up.




When more than 32 stations are used, repeaters (line amplifiers) must be used to connect the individual bus segments.

The maximum cable length depends on the transmission speed and cable type (see Table 2). The specified cable length can be increased by the use of repeaters. The use of more than three repeaters in series is not recommended.

## Electrical Characteristics

The following table provides electrical characteristics for network communication cables.

**Table 1: Line Parameters**

| Parameter | Line A | Line B |
|---|---|---|
| **Impedance** | 135 ...165 W (3 to 20 Mhz) | 100 ...130 W (f >100kHz) |
| **Capacity** | <30 pF/m | <60 pF/m |
| **Resistance** | <110 W /km | - |
| **Wire gauge** | >0,64 mm | >0,53 mm |
| **Conductor area** | >0,34 mm | >0,22 mm |

## Transmission Line Lengths

The following table shows the cable lengths to be used at different transmission speeds.

**Table 2: Line Lengths for Different Transmission Speeds**

| Baud rate (kbit/s) | 9.6 | 19.2 | 93.75 | 187.5 | 500 | 1500 | 3000-12000 |
|---|---|---|---|---|---|---|---|
| Length line A (m) | 1200 | 1200 | 1200 | 1000 | 400 | 200 | 100 |
| Length line B (m) | 1200 | 1200 | 1200 | 600 | 200 | - | - |

## Connection Cables

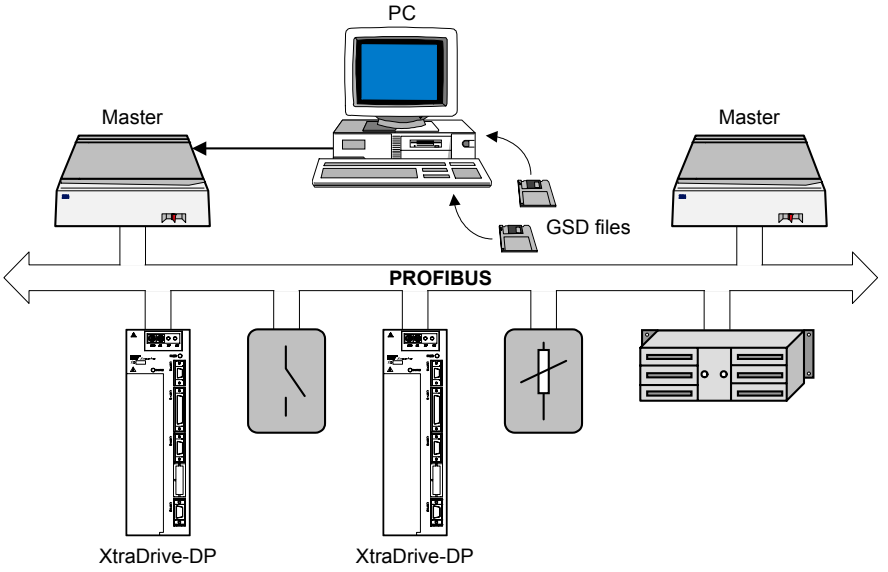
The following are examples of cables that may be used to connect XtraDrive-DP to a PROFIBUS network:

- Desina - PROFIBUS cable - Catalog no. 3DRX 22X 02R
- Siemens - PROFIBUS cable - Catalog no. V45467-G16-C85-G1

# Connecting XtraDrive-DP to a PROFIBUS Network

## Overview

The diagram below shows a typical configuration of XtraDrive-DPs on a PROFIBUS network.




A typical configuration consists of the following components:

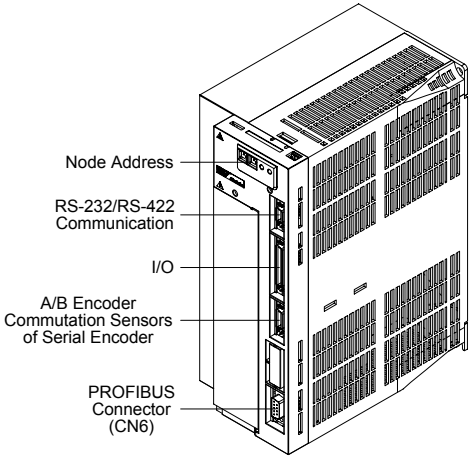
- Using a PC-based configuration tool, you create a project containing parameterization and configuration information for the XtraDrive-DP, which is then downloaded to a master.
- A master receives this information from a PC and then uses it to control the activity of the XtraDrive-DP slaves.

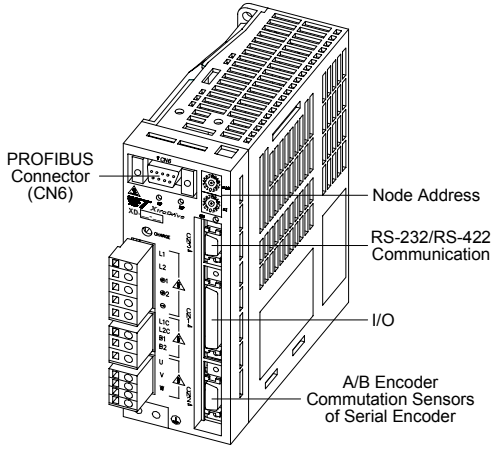
- XtraDrive-DP slaves receive commands from the master and produce data that are sent back to the master. Information is continuously and cyclically transmitted between the master and the XtraDrive-DP over the PROFIBUS network during data exchange.
- Other types of slaves may be connected to the PROFIBUS network as well.

## PROFIBUS Connection Port (CN6)

Use a 9-pin D-sub connector to connect to a PROFIBUS network, using RS-485 communications.

The diagrams below show the various connection ports on an XtraDrive-DP. The placement of the various ports varies on different models. However, the PROFIBUS connection port is always labeled CN6.



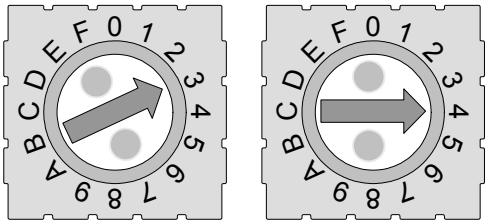




For information about other connections on the XtraDrive-DP, refer to the *XtraDrive User Manual*.

# Setting the Node Address

The second stage of the installation process is setting the node address.

Set the PROFIBUS node address by rotating the rotary switches located on the front of the XtraDrive-DP. Use a small flat screwdriver to set the switches to an available node address, from 0 to 125. Note that x10 represents the hexadecimal sixteens place (MSB) and x1 represents the units place (LSB). For example, to set a node address of 52, you should set rotary switches to 34 Hex, meaning that the MSB dial (x10) should be turned to 3 and the LSB dial (x1) should be turned to 4.




x10 x1

The status of the node address rotary switches is only read immediately after power on. You should take note of this fact when changing the node address.

# LED Indicators

The front of the XtraDrive-DP contains two LEDs that indicate the XtraDrive-DP's status. One of the LEDs displays bus information and the other displays system information.

Each of the LEDs can have three states.

- System failure LED
  - When the LED is green, no system failure has occurred.
  - When the LED is red, a system failure has occurred.
  - When the LED is blinking red, a warning or alarm has occurred.

**NOTE:**

If the system failure LED indicates that a warning message or alarm has been received, refer to the *XtraDrive User Manual* for further information.

- Bus failure LED
  - When the LED is green, data exchange is taking place.
  - When the LED is red, no communication is taking place.
  - When the LED is blinking red, communication is taking place but the XtraDrive-DP is not performing data exchange.

# Chapter 3

# Working with XtraDrive-DP



## About This Chapter

This chapter discusses the main stages of working with XtraDrive-DP on a PROFIBUS network, the various types of parameters that can be set and diagnostics available for XtraDrive-DP.


- **Overview**, page 24, provides an introduction to XtraDrive-DP functionality and how it fits into a PROFIBUS network.
- **Setting Up XtraDrive-DP**, page 25, describes the major steps involved in setting up, parameterizing and configuring a PROFIBUS network.
- **Sending Commands**, page 33, describes the steps to follow in order to send commands during data exchange.
- **Setting XtraDrive-DP Parameters**, page 37, describes three different methods for setting parameters on the XtraDrive-DP.
- **Reading Variables**, page 39, describes how to define variables that that will be used to transmit data during data exchange.
- **Downloading XtraDrive-DP Programs**, page 40, provides two methods for downloading programs to an XtraDrive-DP.

- **Starting Program Synchronization**, page 41, describes how to synchronize the starting of programs on multiple XtraDrive-DP slaves.
- **Diagnostics**, page 42, describes the structure of alarm, warning and error messages from XtraDrive-DP.

# Overview

In order to take advantage of PROFIBUS network functionality, the XtraDrive-DP must be configured in a specific way. Firstly, a GSD file is installed via a PROFIBUS DP configuration tool, enabling access to all the parameters associated with the XtraDrive-DP. Once the GSD file has been installed, by selecting the required module, you define a set of parameters and/or the data exchange I/O structure to be used.

# Setting Up XtraDrive-DP

## Installing GSD Files

The first step in setting up an XtraDrive-DP is to install its associated GSD file, according to the requirements of the configuration tool you are using.

## Using Modules to Set Up XtraDrive-DP

The next step is to select the XtraDrive-DP modules that will be used in your application.

The XtraDrive GSD file (YETM07AA.GSD) provides a list of modules you can choose to setup the XtraDrive-DP for specific applications.

During this stage, you use a standard configuration tool to set the parameters and determine the structure of the data that is transferred during data exchange. Later, these parameters are sent to the XtraDrive-DP during the parameterization and configuration stages.

The following modules are used for setting up applications:

- System Setup (mandatory), page 26
- Digital I/O, page 26
- Command, page 27
- XtraDrive Status, page 28
- System Profile, page 29
- Pulse-Train Input, page 29
- Speed Control (Analog Reference), page 30

- Torque Control (Analog Reference), page 30
- Position Variables, page 30
- Speed Variables, page 31
- Torque Variables, page 31
- Get Parameters, page 32

The order of the fields in each module is fixed, but the placement of the module changes according to your definitions.

For a detailed explanation of variables and commands, refer to the *XtraWare User's Manual*.

## System Setup

This module determines the XtraDrive-DP's mode of operation. Selecting this module is mandatory.

The system setup parameters are:

- Control method
- Stop mode
- Setting system limits
- Motor direction
- Turning off the motor

## Digital I/O

This module is used for defining and reading XtraDrive-DP's external input and output.

The digital I/O parameters are:

- Type of response for each signal input
- Digital data that will be transmitted for each output.

The following table shows the digital I/O module I/O map:

| Digital I/O (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Inputs_state |
| 4 | 4 | Outputs_state |

## Command

This module is used for sending XtraDrive-DP's commands from the master.

The command module parameters are:

- ✦ User units
- ✦ Default profile value of velocity, acceleration and jerk smoothing time
- ✦ Program definitions

The following table shows the command module I/O map:

| Command (output) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 2 | ID |
| 2 | 1 | Op_Code |
| 3 | 1 | Mode |
| 4 | 4 | Command_Parameter_1 |
| 8 | 4 | Command_Parameter_2 |
| 12 | 4 | Command_Parameter_3 |
| 16 | 4 | Command_Parameter_4 |
| 20 | 4 | Command_Parameter_5 |

## XtraDrive Status

This module is used for reading the XtraDrive-DP's status by the master.

The following table shows the XtraDrive status module I/O map:

| XtraDrive Status (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Status_word |
| 4 | 4 | Clock |
| 8 | 1 | Mode_of_operation |
| 9 | 1 | Command_mode |

## System Profile

This module is used for reading the XtraDrive-DP's system profile.

The following table shows the system profile module I/O map:

| System profile (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Profile_velocity |
| 4 | 4 | Profile_acceleration |
| 8 | 4 | Jerk_smoothing_time |
| 12 | 4 | Max_profile_velocity |
| 16 | 4 | Max_profile_acceleration |
| 20 | 2 | CW_Torque_limit |
| 22 | 2 | CCW_Torque_limit |
| 24 | 2 | Application_gain |
| 26 | 1 | Motion_end_window |
| 27 | 1 | Exact_mode |

## Pulse-Train Input

This module is used for reading the pulse-train.

The pulse-train parameters are:

- Pulse-Train gear
- Synchronized window

## Speed Control (Analog Reference)

This module is used to determine the speed control's mode of operation.

The speed control parameters are:

- Velocity control loop
- Acceleration
- Speed

## Torque Control (Analog Reference)

This module is used to determine the torque control's mode of operation.

The torque control parameters are:

- Torque limits
- Emergency stop
- Speed limit

## Position Variables

This module is used for reading the XtraDrive-DP's position variables.

The following table shows the position variables module I/O map:

| Position variables (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Target_position |
| 4 | 4 | Position_demand_value |
| 8 | 4 | Position_actual_value |
| 12 | 4 | Following_error_actual_value |
| 16 | 4 | User_encoder |

## Speed Variables

This module is used for reading the XtraDrive-DP's speed variables.

The following table shows the speed variables module I/O map:

| Speed variables (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Target_velocity |
| 4 | 4 | Velocity_demand_value |
| 8 | 4 | Velocity_actual_value |

## Torque Variables

This module is used for reading the XtraDrive-DP's torque variables.

The following table shows the torque variables module I/O map:

| Speed variables (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 4 | Target_position |
| 4 | 4 | Position_demand_value |

## Get Parameters

This module is used for reading the answer to the Get Parameters command.

**NOTE:**

In order to use the **Get Parameters** module, you must also choose **Command**.

The following table shows the get parameters module I/O map:

| Speed variables (input) | | |
|---|---|---|
| **Offset** | **Size (bytes)** | |
| 0 | 2 | ID |
| 2 | 2 | Number |
| 4 | 2 | Value |

# Sending Commands

Perform the following steps in order to send commands during data exchange:

**1** Select the command module (see *Setting Up XtraDrive-DP*, page 25).

**2** During data exchange, the master sends the command to the XtraDrive-DP.

The command message contains the following fields:

- ID - A numeric identifier that is used to associate between the command and the relevant command response or diagnostic.
- Op_code - Shown in the table on page 34.
- Mode:
  - **Immediate** (Mode 2): Use this mode in order to issue a single command for immediate execution (for example, changing the state of an output while a program is running, or lowering the gain while the motor is enabled).
  - **Program download** (Mode 4): Use this mode when downloading a program to the XtraDrive-DP.
  - **Sequential** (Mode 3): Use this mode when the master sends a command stream that should be executed as a program (for example, move the motor and wait for the motion to complete, wait for input, or execute another move).
- Command Parameter 1 — Command parameter 5 - Command arguments.

The table below lists all the commands and their opcodes (in decimal format):

| Name | Op_Code | Command Parameters | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| ACCELERATION | 64 | Acceleration | | |
| CALL | 66 | Label | | |
| CONTROL | 69 | ON=1/OFF=0 | | |
| DELAY | 144 | Delay [ms] | | |
| END | 70 | | | |
| GAIN | 71 | Gain [%] | | |
| GET_PAR | 85 | Parameter Number | | |
| GO | 112 | Target | Motion Time [ms] | |
| GO_D | 128 | Target | Motion Time [ms] | |
| GO_H | 117 | Target | | |
| GO_TO | 73 | Label | | |
| HARD_HOME | 131 | Torque [0.1% of rated] | Speed | |
| HOME_C | 133 | Speed | | |
| HOME_SW | 132 | Speed to switch | Return Speed | |
| HOME_SW_C | 130 | Speed to switch | Speed to C-pulse | |
| IF* | 105 | Variable Index | | |
| IF_INPUT | 89 | Input Number | | |
| INPUT_CASE | 97 | Inputs Mask | Inputs State | |
| JERK_TIME | 74 | Time [us] | | |
| LABEL | 88 | Label | | |

* This command has 5 parameters. For more information, refer to the *XtraWare User's Manual*.

| Name | Op_Code | Command Parameters | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| LOOP | 75 | Loop Level | Number of cycles | Label |
| MOVE | 113 | Distance | Motion Time [ms] | |
| MOVE_D | 129 | Distance | Motion Time [ms] | |
| MOVE_H | 118 | Distance | | |
| MOVE_R | 119 | Distance | | |
| PT_FOLLOWER | 101 | ON=1/OFF=0 | | |
| RETURN | 77 | | | |
| RUN | 78 | Label | | |
| SET_OUT | 79 | Output Number | ON=1/OFF=0 | |
| SET_PAR | 80 | Parameter Number | Value | |
| SET_VAR | 81 | Variable | Value | |
| SET_ZERO_POSITION | 95 | | | |
| SLIDE | 115 | Speed | | |
| SLIDE_ANALOG | 102 | | | |
| SPEED | 83 | Speed | | |
| SPEED_CONTROL | 100 | Speed Control | | |
| START | 82 | | | |
| STOP | 84 | Control ON=0/ Control OFF=1 | | |
| STOP_MOTION | 99 | | | |
| TORQUE | 116 | Torque [0.1% of rated] | | |
| TORQUE_ANALOG | 103 | | | |
| TORQUE_LIMITS | 87 | CW [0.1% of max] | CCW [0.1% of max] | |
| WAIT_EXACT | 145 | Timeout [ms] | | |

| Name | Op_Code | Command Parameters | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| WAIT_FOR_START | 146 | | | |
| WAIT_INPUT | 147 | Input Number | Timeout [ms] | |
| WAIT_STOP | 148 | Timeout [ms] | | |
| WAIT_VARIABLE_GT | 149 | Variable | Value | |
| WAIT_VARIABLE_LT | 150 | Variable | Value | |

# Setting XtraDrive-DP Parameters

XtraDrive-DP parameters define how the XtraDrive-DP will operate.

Refer to *Appendix B, XtraDrive-DP Parameters List* for a complete list of all XtraDrive-DP parameter modules, their parameter numbers and descriptions. More detail is provided in the *XtraDrive User Manual*.

Parameters can be set using any of three methods:

- **Setting Parameters at Parameterization**Error! Reference source not found., below, describes parameters that are set using a PROFIBUS DP configuration tool during initial configuration.
- **Setting Parameters During Data Exchange**, page 38, describes how to change parameters using external commands during data exchange.
- **Setting Parameters with XtraWare**, page 38, describes the option to change parameters using XtraWare and download them to the XtraDrive-DP.

## Setting Parameters at Parameterization

You select the relevant modules and define the value of the parameters with a PROFIBUS DP configuration tool, and download them to the master. Refer to *Appendix E, Example of Using XtraDrive-DP*.

# Setting Parameters During Data Exchange

Using this method, you can modify parameters using the SET_PAR command during data exchange. To enable the ability to set parameters during data exchange, you must first select the Command module during configuration. Then, during data exchange, you use the SET_PAR command to change selected parameters. See *Command* on page 27 for further details.

# Setting Parameters with XtraWare

XtraWare is an advanced PC-based software tool that can be used to change parameters. An overview of XtraWare's functionality is provided in *Appendix D, Working with XtraWare*.

**NOTE:**

- Only XtraWare may change password-protected parameters.
- XtraWare may not change parameters that have been set and configured with the PROFIBUS DP configuration tool.

XtraWare can be downloaded from YET's website: www.yetmotion.com.

# Reading Variables

You define the variables you want to read by choosing at least one of the following modules during configuration (see *Setting Up XtraDrive-DP*, page 25). The variables are read in a predefined, fixed order. You can choose one or more of these modules and define the order of the modules, but not the order of the variables within the modules.

Timeline refers to the lapse time for the transfer of a message between the PROFIBUS I/O map and the XtraDrive-DP.

| Module | Offset | Size | Description | Timeline (µs) |
|---|---|---|---|---|
| XtraDrive Status | 0 | 4 | Status_word | 125 |
| | 4 | 4 | Clock | 2000 |
| | 8 | 1 | Mode_of_operation | 2000 |
| | 9 | 1 | Command_mode | 2000 |
| System Profile (optional) | 0 | 4 | Profile_velocity | 2000 |
| | 4 | 4 | Profile_acceleration | 2000 |
| | 8 | 4 | Jerk_smoothing_time | 2000 |
| | 12 | 4 | Max_profile_velocity | 2000 |
| | 16 | 4 | Max_profile_acceleration | 2000 |
| | 20 | 2 | CW_Torque_limit | 2000 |
| | 22 | 2 | CCW_Torque_limit | 2000 |
| | 24 | 2 | Application_gain | 2000 |
| | 26 | 1 | Motion_end_window | 2000 |
| | 27 | 1 | Exact_mode | 2000 |

| Module | Offset | Size | Description | Timeline (µs) |
|---|---|---|---|---|
| Position Variables | 0 | 4 | Target_position | 125 |
| | 4 | 4 | Position_demand_value | 2000 |
| | 8 | 4 | Position_actual_value | 125 |
| | 12 | 4 | Following_error_actual_value | 125 |
| | 16 | 4 | User_encoder | 2000 |
| Speed Variables | 0 | 4 | Target_velocity | 2000 |
| | 4 | 4 | Velocity_demand_value | 2000 |
| | 8 | 4 | Velocity_actual_value | 2000 |
| Torque Variables | 0 | 2 | Target_torque | 2000 |
| | 2 | 2 | Torque_demand_value | 2000 |

# Downloading XtraDrive-DP Programs

You can download programs to an XtraDrive-DP in one of two ways:

- From a PC via the serial port to the XtraDrive-DP, by using the XtraWare software. This is the recommended method.
- Via the PROFIBUS network during data exchange, by downloading a program line by line. In the command, the mode field is set to program download (mode 4) and the ID field is set to the program's line number to be downloaded.

**NOTE:**

In order to download programs to the XtraDrive-DP during data exchange, you must first chose the Command module during configuration.

For further information, refer to the *XtraDrive User Manual*.

# Starting Program Synchronization

XtraDrive-DP is designed to enable the synchronization of the start of programs on a group of drives, within a maximum time gap of 125 µsec. To enable this functionality, use the PROFIBUS SYNC command.

SYNC is a PROFIBUS control command, which is sent (broadcast) to multiple slaves simultaneously. After the slaves receive the SYNC command from the master, output is frozen in its current state and new outputs are not sent to XtraDrive-DP until the next SYNC command.

Start program synchronization includes the following steps:

- You add to program the WAIT_TO_START command, before first movement command.
- During data exchange, the master sends a RUN < label > command to each XtraDrive.
- The program runs until the first movement is ready to be executed (location in MCB - Motion Command Buffer).
- The master checks if the status word's 8th bit (Ready for Start) is set to 1 in each drive.
- The master sends a SYNC command to the group of XtraDrives.
- During data exchange, the master sends a START command to each XtraDrive.
- (Mode - broadcast). The command will not execute until the next SYNC command.
- The master sends a second SYNC command to the group of XtraDrives.

# Diagnostics

A PROFIBUS network enables a slave to report back to the master regarding problems on the network.

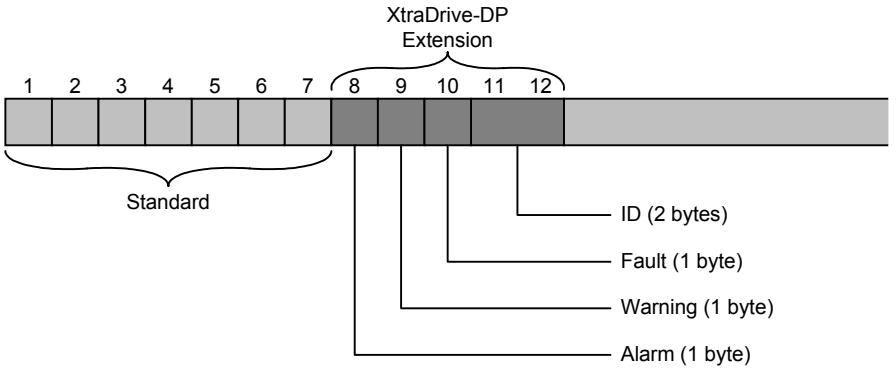
Diagnostics take place during the normal process of data exchange. To initiate a diagnostics request, XtraDrive-DP sends an error flag in the frame control to the master. The master then sends a diagnostic request that is answered by XtraDrive-DP.

The master can request diagnostic information at different times:

- Before downloading parameters, to make sure the field device is available.
- Before entering the data exchange mode, to validate parameters and configuration and make sure the field device is ready.
- During data exchange, whenever indicated by the field device.

The XtraDrive-DP diagnostic information that is sent to the master consists of standard PROFIBUS diagnostic information, plus additional diagnostic information for the XtraDrive-DP: alarms, warnings, faults and command IDs.

The structure of an XtraDrive-DP diagnostic message is shown in the following diagram:



The following information is contained in a diagnostic message:

- Bytes 1-6 contain standard PROFIBUS diagnostic information.
- Byte 7 contains information about the length of the extension in the message that will contain the required XtraDrive-DP diagnostics.

The next five bytes contain diagnostic information specifically for the XtraDrive-DP. This is shown graphically in the diagram on page 42.

- Byte 8 contains a code for alarms.

  Alarm messages refer to XtraDrive-DP states.

  After receiving an alarm message, in order to continue work you must restart the XtraDrive-DP.
- Byte 9 contains a code for warnings.

  Warning messages refer to problems that may become alarms, such as decreasing battery voltage.
- Byte 10 contains a code for faults.

  Fault messages refer to XtraDrive-DP motion commands, and can appear only at command execution.
- Bytes 11 and 12 contain a command ID (relevant only for faults), where the ID specifies the command that caused the fault.

**NOTE:**

Refer to the *Appendix C, XtraDrive-DP Alarms, Warnings and Faults* for a complete list of alarm, warning and fault messages.

To solve problems resulting from alarm or fault messages, refer to the *XtraDrive User Manual*. To solve problems resulting from warning messages, refer to the *XtraWare User's Manual*.

# XtraDrive-DP's Response to Clear Data Control Command

When XtraDrive-DP receives a Clear Data control command (sent by master class 1), it performs the following steps:

- Stops all motion, if the motion command is executing.
- Turns the servo off.
- Keeps the last state of XtraDrive-DP's digital output.

# Appendix A

# XtraDrive-DP GSD File



The GSD file contains all the parameters available for use on the XtraDrive-DP. Download the most updated GSD file (YETM07AA.GSD) from www.yetmotion.com or from www.profibus.com before beginning to work with the XtraDrive-DP.

# Appendix B

# XtraDrive-DP Parameters List

| Module | Name | Description |
|---|---|---|
| System Parameters | Pn000.0: Direction Selection | **Direction Selection:**<br>0 — Forward direction<br>1 — Reverse direction |
| | Pn000.1: Control Method Selection | **Control Method Selection:**<br>0 — Speed (analog)<br>2 — Torque (analog)<br>3 — Speed (contact)<br>4 — Speed (contact/analog)<br>6 — Speed (contact)/torque (analog)<br>9 — Torque (analog)/speed (analog)<br>A — Speed control (analog)/zero clamp<br>C — NCT: Position control (pulse train)<br>D — NCT: Programming mode |
| | Pn000.2 | **Reserved** |
| | Pn000.3 | **Reserved** |
| | Pn001.0: Servo OFF/Alarm Stop Mode | **Servo OFF/Alarm Stop Mode:**<br>0 — Apply dynamic brake (stop)<br>1 — Apply & release dynamic brake (stop)<br>2 — Stop without dynamic brake (coast) |

| Module | Name | Description |
|---|---|---|
| System Parameters | Pn001.1: Overtravel Stop Mode | **Overtravel Stop Mode:**<br>0 — Same as Pn001.0<br>1 — Maximum torque Pn406, servo lock<br>2 — Maximum torque Pn406, coast state |
| | Pn001.2: AC/DC Power Input | **AC/DC Power Input Selection:**<br>0 — Input AC power via L1, L2, L3 terminals<br>1 — Input DC power via +1, - terminals |
| | Pn001.3: Warning Code Output | **Warning Code Output Selection:**<br>0 — ALO1, 2, 3 output alarm codes only<br>1 — ALO1, 2, 3 output both alarms & warnings |
| | Pn002.0: Speed Control (Uses T-REF) | **Speed Control Option (T-REF Terminal Allocation):**<br>0 — None<br>1 — External torque limit input<br>2 — Torque feed-forward input<br>3 — External torque limit when P/N-CL=ON |
| | Pn002.1: Torque Control (V-REF) | **Torque Control Option (V-REF Terminal Allocation):**<br>0 — None<br>1 — VREF is external speed limit input |
| | Pn002.2: Absolute Encoder Usage | **Absolute Encoder Usage:**<br>0 — Use as absolute encoder<br>1 — Use as incremental encoder<br>2 — Absolute encoder with multiturn limit |
| | Pn002.3 | **Not Used** |

| Module | Name | Description |
|---|---|---|
| System Parameters | Pn103: Inertia Ratio | **Inertia Ratio:** This parameter enables you to enter a rough estimation of your system's external load, as a percentage of the motor's inertia. |
| | Pn110.0 | **Reserved** |
| | Pn110.1 | **Reserved** |
| | Pn110.2 | **Reserved** |
| | Pn110.3 | **Reserved** |
| | Pn200.0: Reference Pulse Form | **Reference Pulse Form:**<br>0 — Sign & pulse, positive logic<br>1 — CW & CCW, positive logic<br>2 — AB (x1), positive logic<br>3 — AB (x2), positive logic<br>4 — AB (x4), positive logic<br>5 — Sign & pulse, negative logic<br>6 — CW & CCW, negative logic<br>7 — AB (x1), negative logic<br>8 — AB (x2), negative logic<br>9 — AB (x4), negative logic |
| | Pn200.1: Error Counter Clear Signal Form | **Error Counter Clear Signal Form:**<br>0 — Clear error counter when signal=high<br>1 — Clear error counter on signal rising edge<br>2 — Clear error counter when signal=low<br>3 — Clear error counter on signal falling edge |

| Module | Name | Description |
|---|---|---|
| System Parameters | Pn200.2: Clear Operation | **Clear Operation:**<br>0 — Clear error counter at base block<br>1 — Does not clear error counter<br>2 — Clear error counter on alarm<br>3 — Clear signal ignore |
| | Pn200.3: Filter | **Filter Selection:**<br>0 — Reference input filter: line driver<br>1 — Reference input filter: open collect |
| | Pn205: Multi-turn Limit Setting | **Multi-turn Limit Setting:** This parameter periodically clears the encoder's counter (that is, returns the setting to 0) after a predefined ratio of motor-to-load axis revolutions. |
| | Pn2A9: Quick Stop Deceleration (High) | **Quick Stop Deceleration (High):** This parameter, together with Pn2A8, defines the motor's deceleration when a STOP command is issued. |
| | Pn2A8: Quick Stop Deceleration (Low) | **Quick Stop Deceleration (Low):** This parameter, together with Pn2A9, defines the motor's deceleration when a STOP command is issued. |
| | Pn505: Overflow Level | **Overflow Level:** This parameter defines the Position error overflow level. The units are user units x 256. |
| | Pn506: Brake to Servo OFF Time | **Brake Reference Servo OFF Delay Time:** This parameter sets the delay between the time when the Brake Reference signal is issued until the servo is off. |
| | Pn507: Brake Reference Output Speed Level | **Brake Reference Output Speed Level:** Speed level for brake reference output during motor operation |

| Module | Name | Description |
|---|---|---|
| System Parameters | Pn508: Brake Reference On Time | Timing for brake reference output during motor operation |
| | Pn509: Momentary Hold Time | **Momentary Hold Time:** This parameter determines if an alarm is generated when a power loss occurs. |
| | Pn600: Regenerative Resistor Capacity | **Regenerative Resistor Capacity:** This parameter specifies the capacity for an external regenerative resistor. |
| Digital I/O | Pn502: Rotation Detection Level | **Rotation Detection Level:** This parameter sets the speed at which the servo amplifier determines that the servomotor is running and, if so, to output an appropriate signal. |
| | Pn504: /NEAR Signal Width | **/NEAR Signal Width** |
| | Pn500: Positioning Completed Width | **Positioning Completed Width:** This parameter sets the number of error pulses and adjusts the output timing of the positioning completed signal. |
| | Pn503: Speed Coincidence Signal Output Width | **Speed Coincidence Signal Output Width:** This parameter sets the required conditions for speed coincidence output. |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn2D0.0: Program Input 1 | **Program Input 1:**<br>0 — SI0 (CN1-40)<br>1 — SI1 (CN1-41)<br>2 — SI2 (CN1-42)<br>3 — SI3 (CN1-43)<br>4 — SI4 (CN1-44)<br>5 — SI5 (CN1-45)<br>6 — SI6 (CN1-46)<br>7 — ON<br>8 — OFF |
| | Pn2D0.1: Program Input 2 | **Program Input 2:**<br>Refer to Pn2D0.0, page 52. |
| | Pn2D0.2: Program Input 3 | **Program Input 3:**<br>Refer to Pn2D0.0, page 52. |
| | Pn2D0.3: Program Input 4 | **Program Input 4:**<br>Refer to Pn2D0.0, page 52. |
| | Pn2D1.0: Emergency Input | **Emergency Input:**<br>0 — SI0 (CN1-40)<br>1 — SI1 (CN1-41)<br>2 — SI2 (CN1-42)<br>3 — SI3 (CN1-43)<br>4 — SI4 (CN1-44)<br>5 — SI5 (CN1-45)<br>6 — SI6 (CN1-46)<br>7 — OFF<br>8 — ON |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn2D1.1: Motion Input (125 µsec) | **Fast Input Detection (125 µsec):**<br>0 — SI0 (CN1-40)<br>1 — SI1 (CN1-41)<br>2 — SI2 (CN1-42)<br>3 — SI3 (CN1-43)<br>4 — SI4 (CN1-44)<br>5 — SI5 (CN1-45)<br>6 — SI6 (CN1-46) |
| | Pn2D1.2: Program Input 5 | **Program Input 5:**<br>Refer to Pn2D0.0, page 52. |
| | Pn2D1.3: Program Input 6 | **Program Input 6:**<br>Refer to Pn2D0.0, page 52. |
| | Pn2C7.0: Home Switch Input | **Home Switch Input:**<br>0 — SI0 (CN1-40)<br>1 — SI1 (CN1-41)<br>2 — SI2 (CN1-42)<br>3 — SI3 (CN1-43)<br>4 — SI4 (CN1-44)<br>5 — SI5 (CN1-45)<br>6 — SI6 (CN1-46)<br>7-F — Home failure |
| | Pn2C7.1: Home Switch Polarity | **Home Switch Polarity:**<br>0 — Normally closed (0 Volt logic)<br>1 — Normally open<br>2 — Home failure |
| | Pn2C7.2 | **Reserved** |
| | Pn2C7.3 | **Reserved** |
| | Pn50A.0 | **Reserved** |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn50A.1: /S-ON Input | **/S-ON Signal Mapping (Servo ON when Low):**<br>0 — SI0 (CN1-40)<br>1 — SI1 (CN1-41)<br>2 — SI2 (CN1-42)<br>3 — SI3 (CN1-43)<br>4 — SI4 (CN1-44)<br>5 — SI5 (CN1-45)<br>6 — SI6 (CN1-46)<br>7 — ON<br>8 — OFF<br>9 — SI0 (CN1-40) (Negative Logic)<br>A — SI1 (CN1-41) (Negative Logic)<br>B — SI2 (CN1-42) (Negative Logic)<br>C — SI3 (CN1-43) (Negative Logic)<br>D — SI4 (CN1-44) (Negative Logic)<br>E — SI5 (CN1-45) (Negative Logic)<br>F — SI6 (CN1-46) (Negative Logic) |
| | Pn50A.2: /P-CON Input | **/P-Con Signal Mapping (P-control when Low):**<br>Refer to Pn50A.1, page 54. |
| | Pn50A.3: P-OT Input | **P-OT Signal Mapping (Overtravel when High):**<br>Refer to Pn50A.1, page 54. |
| | Pn50B.0: N-OT Input | **N-OT Signal Mapping (Overtravel when High):**<br>Refer to Pn50A.1, page 54. |
| | Pn50B.1: /ALM-RST Input | **/ALM-RST Signal Mapping (Alarm Reset when Low):**<br>Refer to Pn50A.1, page 54. |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn50B.2: /P-CL Input | **/P-CL Signal Mapping (External Forward Torque Limit Enable according to Pn404):**<br>Refer to Pn50A.1, page 54. |
| | Pn50B.3: /N-CL Input | **/N-CL Signal Mapping (External Reversed Torque Limit Enable:**<br>Refer to Pn50A.1, page 54. |
| | Pn50C.0: /SPD-D Input | **/SPD-D Signal Mapping**<br>**Internal Speed Selection — Selects direction (0 — Forward; 1 — Reversed)**<br>Refer to Pn50A.1, page 54. |
| | Pn50C.1: /SPD-A Input | **/SPD-A Signal Mapping**<br>**Internal Speed Selection — Defines internal speed together with /SPD-B**<br>Refer to Pn50A.1, page 54. |
| | Pn50C.2: /SPD-B Input | **/SPD-B Signal Mapping.**<br>**Internal Speed Selection — Defines internal speed together with /SPD-A**<br>Refer to Pn50A.1, page 54. |
| | Pn50C.3: /C-SEL Input | **/C-SEL Signal Mapping (Control Mode Switching):**<br>Refer to Pn50A.1, page 54. |
| | Pn50D.0: /ZCLAMP Input | **/ZCLAMP Signal Mapping (Zero Clamping):**<br>Refer to Pn50A.1, page 54. |
| | Pn50D.1: /INHIBIT Input | **/INHIBIT Signal Mapping (Disabling Pulse-Train Input):**<br>Refer to Pn50A.1, page 54. |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn50D.2: /G-SEL Input | **/G-SEL Signal Mapping (Gain Switching):**<br>Refer to Pn50A.1, page 54. |
| | Pn50D.3 | **Reserved** |
| | Pn2D2.0: /COIN Output | **/COIN Signal Mapping:**<br>0 — Disabled<br>1 — SO1 (CN1-25,26)<br>2 — SO2 (CN1-27,28)<br>3 — SO3 (CN1-29,30) |
| | Pn2D2.1: Program Output 1 | **Program Output 1:**<br>Refer to Pn2D2.0, page 56. |
| | Pn2D2.2: Program Output 2 | **Program Output 2:**<br>Refer to Pn2D2.0, page 56. |
| | Pn2D2.3: Program Output 3 | **Program Output 3:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50E.0: /COIN Output | **/COIN Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50E.1: /V-CMP Output | **/V-CMP Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50E.2: /TGON Output | **/TGON Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50E.3: /S-RDY Output | **/S-RDY Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50F.0: /CLT Output | **/CLT Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50F.1: /VLT Output | **/VLT Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |

| Module | Name | Description |
|---|---|---|
| Digital I/O | Pn50F.2: /BK Output | **/BK Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn50F.3: /WARN Output | **/WARN Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn510.0: /NEAR Output | **/NEAR Signal Mapping:**<br>Refer to Pn2D2.0, page 56. |
| | Pn510.1 | **Not Used** |
| | Pn510.2 | **Not Used** |
| | Pn510.3 | **Not Used** |
| | Pn512.0: SO1 Output Reversal | **Output Signal Reversal for SO1 (CN1-25, 26):**<br>0 — Output signal not reversed<br>1 — Output signal reversed |
| | Pn512.1: SO2 Output Reversal | **Output Signal Reversal for SO2 (CN1-27, 28):**<br>0 — Output signal not reversed<br>1 — Output signal reversed |
| | Pn512.2: SO3 Output Reversal | **Output Signal Reversal for SO3 (CN1-29, 30):**<br>0 — Output signal not reversed<br>1 — Output signal reversed |
| | Pn512.3 | **Not Used** |

| Module | Name | Description |
|---|---|---|
| Command | Pn2A3: Work Speed Default (High) | **Work Speed Default (High):** This parameter, together with Pn2A2, defines the default value of the profile speed variable. |
| | Pn2A2: Work Speed Default (Low) | **Work Speed Default (Low):** This parameter, together with Pn2A3, defines the default value of the profile speed variable. |
| | Pn2A5: Work Acceleration Default (High) | **Work Acceleration Default (High):** This parameter, together with Pn2A4, defines the default value of the profile acceleration variable. |
| | Pn2A4: Work Acceleration Default (Low) | **Work Acceleration Default (Low):** This parameter, together with Pn2A5, defines the default value of the profile acceleration variable. |
| | Pn2A6: Work Jerk - Smoothing Time | **Work Jerk-Smoothing Time Default:** This parameter defines the default value of the jerk-smoothing time variable. |
| | Pn2B1: Position Units Ratio Number (High) | **Position Units Ratio Numerator (High):** This parameter, together with Pn2B0, sets the numerator to be used in the ratio to convert position units from user units to encoder counts. |
| | Pn2B0: Position Units Ratio Number (Low) | **Position Units Ratio Numerator (Low):** This parameter, together with Pn2B1, sets the numerator to be used in the ratio to convert position units from user units to encoder counts. |

| Module | Name | Description |
|---|---|---|
| Command | Pn2B3: Position Units Ratio Den (High) | **Position Units Ratio Denominator (High):** This parameter, together with Pn2B2, sets the denominator to be used in the ratio to convert position units from user units to encoder counts. |
| | Pn2B2: Position Units Ratio Denominator (Low) | **Position Units Ratio Denominator (Low):** This parameter, together with Pn2B3, sets the denominator to be used in the ratio to convert position units from user units to encoder counts. |
| | Pn2B5: Speed Units Ratio Numerator (High) | **Speed Units Ratio Numerator (High):** This parameter, together with Pn2B4, sets the numerator to be used in the ratio to convert speed units from user speed units to encoder counts/msec. |
| | Pn2B4: Speed Units Ratio Numerator (Low) | **Speed Units Ratio Numerator (Low):** This parameter, together with Pn2B5, sets the numerator to be used in the ratio to convert speed units from user speed units to encoder counts/msec. |
| | Pn2B7: Speed Units Ratio Denominator (High) | **Speed Units Ratio Denominator (High):** This parameter, together with Pn2B6, sets the denominator to be used in the ratio to convert speed units from user speed units to encoder counts/msec. |

| Module | Name | Description |
|---|---|---|
| Command | Pn2B6: Speed Units Ratio Denominator (Low) | **Speed Units Ratio Denominator (Low):** This parameter, together with Pn2B7, sets the denominator to be used in the ratio to convert speed units from user speed units to encoder counts/msec. |
| | Pn2B9: Acceleration Units Ratio Numerator (High) | **Acceleration Units Ratio Numerator (High):** This parameter, together with Pn2B8, sets the numerator to be used in the ratio to convert acceleration units from user acceleration units to encoder counts/(10 msec)$^2$. |
| | Pn2B8: Acceleration Units Ratio Numerator (Low) | **Acceleration Units Ratio Numerator (Low):** This parameter, together with Pn2B9, sets the numerator to be used in the ratio to convert acceleration units from user acceleration units to encoder counts/(10 msec)$^2$. |
| | Pn2BB: Acceleration Units Ratio Denominator (High) | **Acceleration Units Ratio Denominator (High):** This parameter, together with Pn2BA, sets the denominator to be used in the ratio to convert acceleration from user acceleration units to encoder counts/(10 msec)$^2$. |
| | Pn2BA: Acceleration Units Ratio Denominator (Low) | **Acceleration Units Ratio Denominator (Low):** This parameter, together with Pn2BB, sets the denominator to be used in the ratio to convert acceleration units from user acceleration units to encoder counts/(10 msec)$^2$. |

| Module | Name | Description |
|---|---|---|
| Command | Pn2C0: Motion End Window | **Motion End Window:** This parameter defines the default value of the window of acceptable position errors after a motion has been completed. |
| | Pn2C1: Torque Slope | **Torque Slope:** This parameter defines the default value, as 0.1% of the rated torque/1 msec, for the torque slope command. |
| | Pn2CC: AutoStart User Program | **Auto-Start User Program:** This parameter specifies the label number (1-99) of the user program to start when the power is turned on. If the value is set to 0, then no program is automatically run. |
| Pulse-Train Input | Pn202: Pulse-Train Gear Ratio (Numerator) | **Pulse-Train Electronic Gear Ratio (Numerator):** When using pulse train, this parameter sets the numerator to be used in the electronic gear function. |
| | Pn203: Pulse-Train Gear Ratio (Denominator) | **Pulse-Train Electronic Gear Ratio (Denominator):** When using pulse train, this parameter sets the denominator to be used in the electronic gear function. |
| | Pn2C4: Synchronized Window (Pulse-Train) | **Synchronized Window for Pulse-Train:** This parameter defines the window of acceptable synchronization errors in a dynamic motion, as used by the Follower_Synchronize flag. |

| Module | Name | Description |
|---|---|---|
| Speed Control — Analog Reference | Pn305: Soft Start Acceleration Time | **Soft Start Acceleration Time:** This parameter sets the interval between the time when the servomotor starts until it reaches maximum speed (contact reference). |
| | Pn306: Soft Start Deceleration Time | **Soft Start Deceleration Time:** This parameter sets the interval between the time when the servomotor reaches maximum speed until it stops (contact reference). |
| | Pn307: Speed Reference Filter Time | **Speed Reference Filter Time Constant** |
| | Pn308: Speed Feedback Filter Time | **Speed Feedback Filter Time Constant** |
| | Pn300: Speed Reference Input Gain | **Speed Reference Input Gain:** This parameter sets the voltage range for the V-REF (CN1-5) speed reference input, based on the host controller or external circuit's output range. |
| | Pn100: Speed Loop Gain | **Speed Loop Gain:** When NCT is not used, this parameter, together with Pn101, enables you to ensure that the speed error (the difference between the internal speed command and the actual speed) is as small as possible. |

| Module | Name | Description |
|---|---|---|
| Speed Control — Analog Reference | Pn101: Speed Loop Integral Time | **Speed Loop Integral Time Constant:** When NCT is not used, this parameter, together with Pn100, enables you to ensure that the speed error (the difference between the internal speed command and the actual speed) is as small as possible. |
| | Pn401: Torque Reference Filter Time | **Torque Reference Filter Time Constant:** This parameter sets the torque reference's filter time constant in the servo amplifier; the smaller the value, the faster the speed control response is. |
| | Pn408.0: Notch Filter Selection | **Notch Filter Selection:**<br>0 — Disabled<br>1 — Use notch filter for torque ref |
| | Pn408.1 | **Not Used** |
| | Pn408.2 | **Not Used** |
| | Pn408.3 | **Not Used** |
| | Pn409: Notch Filter Frequency | **Notch Filter Frequency:** This parameter, together with Pn40A, sets the frequency at which the notch filter is effective. |
| | Pn40A: Notch Filter Width | **Notch Filter Width:** This parameter, together with Pn409, sets the frequency at which the notch filter is effective. |

| Module | Name | Description |
|---|---|---|
| Speed Control — Analog Reference | Pn109: Feed Forward (Speed Control) | **Feed-Forward (Speed Control):** When NCT is not used, this parameter is used to shorten positioning time, as well as to differentiate a speed reference at the host controller to generate a torque feed-forward reference and then input this reference together with the speed reference to the servo amplifier.<br>This parameter is applicable only in Speed Control (analog) mode. |
| | Pn102: Position Loop Gain | **Position Loop Gain:** When NCT is not used, this parameter increases stiffness and reduces position error during the trajectory following. |
| | Pn301: Speed 1 | **Speed 1:** In Speed Control (contact reference) mode, this parameter, together with Pn302 and Pn303, enables you to select the motor' s speed. |
| | Pn302: Speed 2 | **Speed 2:** In Speed Control (contact reference) mode, this parameter, together with Pn301 and Pn303, enables you to select the motor' s speed. |

| Module | Name | Description |
|---|---|---|
| Speed Control — Analog Reference | Pn303: Speed 3 | **Speed 2:** In Speed Control (contact reference) mode, this parameter, together with Pn301 and Pn302, enables you to select the motor's speed. |
| | Pn304: Jog Speed | **Jog Speed:** This parameter sets the motor's speed when operating the servomotor from a panel or digital operator. |
| | Pn501: Zero Clamp Level | **Zero Clamp Level:** This parameter sets the motor speed level at which zero clamp is performed. |
| Torque Control — Analog Reference | Pn400: Torque Reference Input Gain | **Torque Reference Input Gain:** This parameter sets the voltage range for the T-REF (CN1-9) torque reference input, based on the host controller or external circuit's output range. |
| | Pn402: Forward Torque Limit | **Forward Torque Limit:** This parameter sets the maximum forward torque limit when torque is limited due to equipment conditions. |
| | Pn403: Reverse Torque Limit | **Reverse Torque Limit:** This parameter sets the maximum reverse torque limit when torque is limited due to equipment conditions. |
| | Pn404: Fwd External Torque Limit | **Forward External Torque Limit:** This parameter sets the maximum forward torque limit when torque is limited by an external contact input. |

| Module | Name | Description |
|---|---|---|
| Torque Control — Analog Reference | Pn405: Reverse External Torque Limit | **Reverse External Torque Limit:** This parameter sets the maximum reverse torque limit when torque is limited by an external contact input. |
| | Pn406: Emergency Stop Torque | **Emergency Stop Torque:** This parameter specifies the stop torque applied for overtravel when using the input signal for prohibiting forward or reverse rotation. |
| | Pn407: Speed Limit (Torque Control) | **Speed Limit During Torque Control:** This parameter sets a speed limit for the motor when torque control is selected, and is used to prevent excessive equipment speed during torque control. |

# Appendix C

# XtraDrive-DP Alarms, Warnings and Faults

## Alarm Messages

A represents an alarm code that is described in more detail in the *XtraDrive User Manual*. Instructions on how to handle these alarms are also provided there.

| Code | Alarm Message |
|---|---|
| 64 | A.02: Parameter Breakdown |
| 65 | A.03: Main Circuit Encoder Error |
| 66 | A.04: Parameter Setting Error |
| 67 | A.05: Servomotor and Amplifier Combination Error |
| 68 | A.10: Overcurrent or Heat Sink Overheated |
| 69 | A.30: Regeneration Error Detected |
| 70 | A.32: Regenerative Overload |
| 71 | A.40: Overvoltage |
| 72 | A.41: Undervoltage |
| 73 | A.51: Overspeed |

| Code | Alarm Message |
|---|---|
| 74 | A.71: Overload: High Load |
| 75 | A.72: Overload: Low Load |
| 76 | A.73: Dynamic Brake Overload |
| 77 | A.74: Overload of Surge Current Limit Resistor |
| 78 | A.7A: Heat Sink Overheated |
| 79 | A.81: Absolute Encoder Backup Power Supply Error |
| 80 | A.82: Encoder Checksum Error |
| 81 | A.83: Absolute Encoder Battery Error |
| 82 | A.84: Absolute Encoder Data Error |
| 83 | A.85: Absolute Encoder Overspeed |
| 84 | A.86: Encoder Overheated |
| 85 | A.B1: Reference Speed Input Read Error |
| 86 | A.B2: Reference Torque Input Read Error |
| 87 | A.BF: System Alarm |
| 88 | A.C1: Servo Overrun Detected |
| 89 | A.C2: Phase finding error |
| 90 | A.C8: Absolute Encoder Clear Error and Multi-Turn Limit Setting Error |
| 91 | A.C9: Encoder Communications Error |
| 92 | A.CA: Encoder Parameter Error |
| 93 | A.CB: Encoder Echoback Error |
| 94 | A.CC: Multi-Turn Limit Disagreement |
| 95 | A.D0: Position Error Overflow |
| 97 | A.F1: Power Line Open Phase |

# Warning Messages

| Code | Warning Message |
|---|---|
| 112 | A.91: Overload |
| 113 | A.92: Regenerative Overload |

# Fault Messages

| Code | Fault Message |
|---|---|
| 1 | Sequential buffer full |
| 2 | Immediate buffer full |
| 4 | Too many program lines/Invalid program line number |
| 5 | Message checksum error* |
| 6 | SET_VAR: Invalid variable index |
| 7 | Variable is read-only |
| 8 | Wrong op_code |
| 9 | SET_ZERO_POSITION: Unable to SET_ZERO_POSITION while executing motion |
| 10 | Reply buffer full |
| 11 | Incomplete message received* |
| 12 | Message too long* |
| 13 | C-phase parameter not set |
| 14 | Invalid input assignment |
| 15 | SET_OUT: Invalid output assignment |
| 16 | Selected traced I/O not in use* |
| 17 | Command prohibited in present control method |

| Code | Fault Message |
|---|---|
| 18 | Parameter storing fault — during auto tuning* |
| 19 | Parameter storing fault |
| 20 | Motor moving during CONTROL_ON |
| 22 | Auto tuning available in Programming Control mode only* |
| 23 | Program already running |
| 24 | Variable does not exist* |
| 25 | Wrong user units setting |
| 26 | Wrong setting profile speed acceleration or jerk |
| 27 | Invalid parameter |
| 28 | EEPROM read buffer full |
| 31 | Home Command: Both speeds are in the same direction |
| 33 | Hard Home: Torque exceeded torque limits |
| 128 | Reference to invalid label |
| 129 | Command not applicable in this programming mode |
| 130 | Can't perform this motion with present profile acceleration |
| 131 | Can't perform this motion with present profile speed |
| 134 | Too low speed |
| 135 | SET_VAR: Variable value out of range |
| 136 | Program flow error |
| 137 | Moving time is too short with present profile jerk time |
| 139 | Home sensor not defined |
| 140 | Motion cannot be executed while CONTROL_OFF |
| 141 | TORQUE_LIMITS: Invalid torque limits |
| 142 | Invalid or duplicated label |
| 143 | Invalid input number |
| 144 | Invalid output number |

| Code | Fault Message |
|---|---|
| 146 | Auto tuning already in progress* |
| 149 | Unable to switch CONTROL_ON |
| 151 | Positive overtravel |
| 152 | Negative overtravel |
| 192 | Command buffer full |
| 193 | Duplicate Configuration module |
| 194 | Command parameter out of range |
| 195 | Parameterization fail |
| 196 | Configuration fail |
| 197 | Wrong GSD file version |
| 198 | Parameterization timeout |
| 199 | Servo circuit communication error |
| 200 | Servo circuit internal watchdog error |
| 201 | Wrong station address* |
| 202 | Command disabled in PROFIBUS data exchange* |
| 205 | Error buffer full |

* These messages are displayed only in XtraWare.

# Appendix D

# Working with XtraWare

XtraWare is an advanced PC-based software tool for the setup, optimal tuning and user programming of the XtraDrive family of products.

Using XtraWare, you are able to perform a variety of functions:

- Write and download a user program
- Immediately execute control commands
- Tune
- Set up
- Edit parameters
- Display alarms
- Perform jog operation
- Monitor
- Provide help
- See system status with a Watch window
- See a graphic representation of changes in parameter values

For further details, refer to the *XtraWare User's Manual*.

XtraWare can be downloaded from YET's website: www.yetmotion.com.

# Appendix E

# Example of Using XtraDrive-DP

## About This Chapter

This appendix provides an example of the usage of XtraDrive-DP on a PROFIBUS network. First it shows how to use the S7 SIMATIC Manager to define the parameterization and configuration processes and then it shows how to implement the application during data exchange.



# Specifications

The following is a list of the system and application tasks to be carried out in this example:

- The XtraDrive-DP will drive a rotary motor with 16-bit encoder.
- The master will instruct the XtraDrive-DP to perform the following tasks:
  - Make a movement of 34.7 degrees at a speed not higher than 1000 RPM.
  - At the end of the movement, the XtraDrive-DP output #1 (CN1-25, 26) will be set to HIGH.
- An S7 SIMATIC Manager is used on the network.

# Workflow

The following main steps must performed to carry out the above specifications:

1. Initialization conditions:
   - ❖ Definition of movement units — 0.1 degrees
   - ❖ Assignment of output #1
2. Send the Movement command.
3. Set the output.

The workflow has three stages, as follows:

1. **System Setup**, page 76, describes how to set up the hardware components used in this example.
2. **Application Setup**, page 78, describes how to set up the commands used to transfer data.
3. **Application Execution During Data Exchange**, page 81, describes how to execute the application during data exchange.

## System Setup

System setup is composed of three steps:

1. Install the XtraDrive GSD File. An updated file (YETM07AA.GSD) can be downloaded from YET's website, http://www.yetmotion.com.

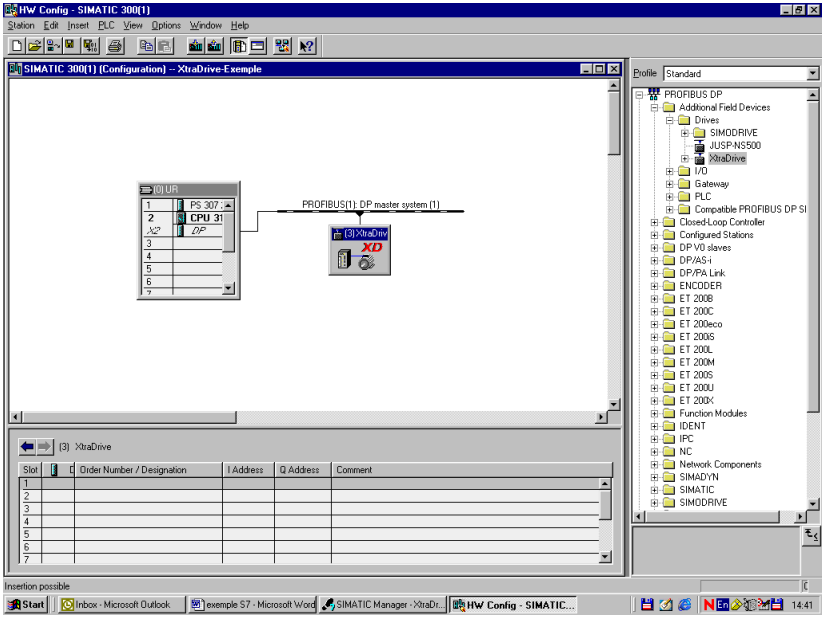
   From the S7's *Options* menu, select **Install New GSD**.

   When the GSD file is loaded, the XtraDrive-DP's name appears in the list of drives in the *Catalog* window.

**2** Select and define the network components: the PLC, XtraDrive-DP, transmission rate, and so on.

Select the hardware components to be used on the PROFIBUS network, starting with the master (including its specific CPU and power supply), and then the network (for example, determining the profile and transmission rate). Once this has been carried out, you must determine the slave XtraDrive-DP and its address. It is important to ensure that this is the same as the address set by the rotary switches on the XtraDrive-DP's front panel.

The picture below displays the system setup as shown in the S7 SIMATIC Manager:




**3** Select the System Parameters module.

**NOTE:**

The three steps described above must be performed for any application.

Once you have finished setting the system definitions and configuration, you can continue with the specific application.

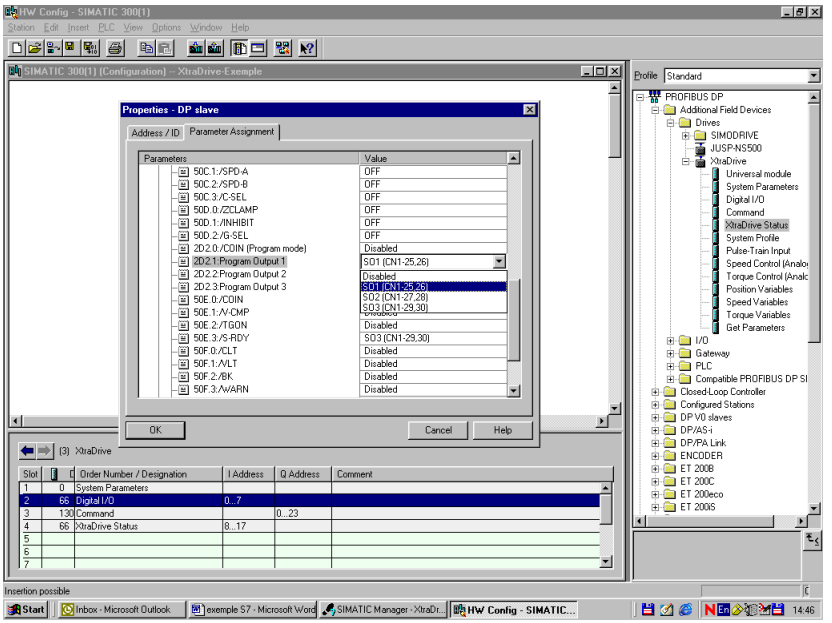
# Application Setup

In this example, the application setup is composed of three steps:

**1** Select the Digital I/O module. This module must be selected for output assignment.

**Pn2D2.1: Program Output 1 = SO1(CN1-25,26)**

The following screen displays this parameter selected:




**2** Select the Command module. This module enables a master to send motion commands during data exchange, as well as allows you set the parameters related to the commands.

In this example, you must define the parameters as follows:

- ❖ User Units
  - Position Units — 0.1 degree

    **Pn2B1/0: Pos.Unts Ratio Num = 65536**

    **Pn2B3/2: Pos.Unts Ratio Den = 3600**

- Speed Units — 1 RPM

  **Pn2B5/4: Spd.Unts Ratio Num = 65536**

  **Pn2B7/6: Spd.Unts Ratio Den = 60000**

- Acceleration Units — 1 rad/sec$^2$

  **Pn2B9/8: Acc.Unts Ratio Num = 65536**

  **Pn2BB/A: Acc.Unts Ratio Den = 62832**

For explanations about how to determines these values, refer to the *XtraDrive User Manual*.

❖ Work Speed

- Default value for working speed — 1000 RPM

  **Pn2A3/2: Work Spd Default = 1000**

❖ Work Acceleration

- Work acceleration default — 10000 rad/sec$^2$

  **Pn2A5/4: Work Accel. Default = 10000**

**3** Select the XtraDrive Status module. While it is not mandatory to select this module, it is helpful in enabling you to retrieve the XtraDrive's working status.

You have now defined the user units, working speed and acceleration, assigned output #1 and defined the structure of I/O data. The XtraDrive is now ready to run the application.

The I/O map for this application is shown below:

| Input | | |
|---|---|---|
| **Offset** | **Size (bytes)** | **Content** |
| 0 | 4 | Digital Input |
| 4 | 4 | Digital Output |
| 8 | 4 | Status_word |
| 12 | 4 | Clock |
| 16 | 1 | Mode_of_operation |
| 17 | 1 | Command_mode |

| Output | | |
|---|---|---|
| **Offset** | **Size (bytes)** | **Content** |
| 0 | 2 | ID |
| 2 | 1 | OP_code |
| 3 | 1 | Mode |
| 4 | 4 | Command_Parameter_1 |
| 8 | 4 | Command_Parameter_2 |
| 12 | 4 | Command_Parameter_3 |
| 16 | 4 | Command_Parameter_4 |
| 20 | 4 | Command_Parameter_5 |

# Application Execution During Data Exchange

The master must send the following commands in Sequential Mode:

| | | |
|---|---|---|
| CONTROL | ON | |
| MOVE_D | 3470 | -1 |
| SET_OUT | 1 | ON |

Three messages will be transferred to XtraDrive-DP during data exchange, as follows:

✦ Message 1 — For the CONTROL ON command:

| **Byte #** | **0-1** | **2** | **3** | **4-7** | **8-11** | **12-15** | **16-19** | **20-23** |
|---|---|---|---|---|---|---|---|---|
| **Value** | 0x0001 | 0x45 | 0x03 | 0x00000001 | 0x00000000 | 0x00000000 | 0x00000000 | 0x00000000 |
| **Explanation** | ID | OP_code | Mode | Command Parameter 1 | Command Parameter 2 | Command Parameter 3 | Command Parameter 4 | Command Parameter 5 |

✦ Message 2 — For the MOVE_D command:

| **Byte #** | **0-1** | **2** | **3** | **4-7** | **8-11** | **12-15** | **16-19** | **20-23** |
|---|---|---|---|---|---|---|---|---|
| **Value** | 0x0002 | 0x81 | 0x03 | 0x00000E10 | 0xFFFFFFFF | 0x00000000 | 0x00000000 | 0x00000000 |
| **Explanation** | ID | OP_code | Mode | Command Parameter 1 | Command Parameter 2 | Command Parameter 3 | Command Parameter 4 | Command Parameter 5 |

✦ Message 3 — For the SET_OUT command:

| Byte # | 0-1 | 2 | 3 | 4-7 | 8-11 | 12-15 | 16-19 | 20-23 |
|---|---|---|---|---|---|---|---|---|
| Value | 0x0003 | 0x4F | 0x03 | 0x00000001 | 0x00000001 | 0x00000000 | 0x00000000 | 0x00000000 |
| Explanation | ID | OP_code | Mode | Command Parameter 1 | Command Parameter 2 | Command Parameter 3 | Command Parameter 4 | Command Parameter 5 |

# Index


## C

Commands
  sending, 33
Configuration, 10, 12
Connection port, 19

## D

Data exchange, 10, 12
Diagnostics, 42

## G

GSD file, 13, 25

## I

I/O configuration, 10, 12

## L

LEDs, 21

## M

Modules
  command, 27
  digital I/O, 26
  get parameters, 32
  position variables, 30
  pulse-train input, 29
  speed control, 30
  speed variables, 31
  system profile, 29
  system setup, 26
  torque control, 30
  torque variables, 31
  XtraDrive status, 28

## N

Nameplate, 7
Node address
  setting, 20

## P

Parameterization, 10, 11
Parameters
  set at parameterization, 37
  set by XtraWare, 38
  set during data exchange, 38
  setting, 37
Power ON/Reset, 10
PROFIBUS connection port, 19
PROFIBUS network, 16
  components, 18
  connecting to, 15, 18
  connection cables, 17
  connection port, 19
  electrical characteristics, 17

introduction, 9
transmission line lengths, 17
XtraDrive-DP operation on, 10
Program Synchronization, 41

## S

Specifications
PROFIBUS, 6
XtraDrive-DP, 4

## T

Type description, 8

## V

Variables
reading, 39

## X

XtraDrive-DP
controlling, 12
diagnostics, 42
downloading programs to master, 40
modules, 25
nameplate, 7
parameters list, 47
setting up, 25, 75
specifications, 4
type description, 8
XtraDrive-DP messages
alarms, 67
faults, 69
warnings, 69
XtraWare, 73